

CLAIMS (for preliminary amendment)

1. A toxic substance assay method of assaying a toxic substance present in an aqueous solution sample to be tested, the toxic substance assay method comprising:

5 a first step of mixing a photosynthetic sample, having a photosynthetic function, with the aqueous solution sample to prepare a test measurement solution, letting the test measurement solution stand for a predetermined standing time, and then after illuminating light onto the test measurement solution for a predetermined illumination time, measuring a light amount of a delayed fluorescence that is emitted;

10 a second step of letting a comparison measurement solution, prepared by mixing the photosynthetic sample with a comparison sample, stand for the predetermined standing time, and then after illuminating light onto the comparison measurement solution for the predetermined illumination time, measuring a light amount of the delayed fluorescence that is emitted to thereby prepare a comparison measurement result; and

15 a third step of computing assay values based on the light amounts of delayed fluorescence, respectively acquired in the first step and the second step, and determining a comparison value of the assay values to assay the toxic substance present in the aqueous solution sample,

20 wherein the assay values are elapsed times of characteristic points in temporal variations of the light amounts of delayed fluorescence acquired in the first step and the second step.

25 2. A toxic substance assay method of assaying a toxic

substance present in an aqueous solution sample to be tested, the toxic substance assay method comprising:

5 a first step of mixing a photosynthetic sample, having a photosynthetic function, with the aqueous solution sample to prepare a test measurement solution, letting the test measurement solution stand for a predetermined standing time, and then after illuminating light onto the test measurement solution for a predetermined illumination time, measuring a light amount of a delayed fluorescence that is emitted;

10 a second step of letting a comparison measurement solution, prepared by mixing the photosynthetic sample with a comparison sample, stand for the predetermined standing time, and then after illuminating light onto the comparison measurement solution for the predetermined illumination time, measuring a light amount of the delayed fluorescence that is emitted to thereby prepare a comparison measurement result; and

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a third step of computing assay values based on the light amounts of delayed fluorescence, respectively acquired in the first step and the second step, and determining a comparison value of the assay values to assay the toxic substance present in the aqueous solution sample,

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wherein the assay values are temporal variations of the light amounts of delayed fluorescence acquired in the first step and the second step, and the comparison value is a value obtained by determining a difference of the temporal variations.

25 3. The toxic substance assay method according to Claim 2, wherein the temporal variation of the light amount of delayed

fluorescence acquired in the first step or the second step has a characteristic point, and in the third step, a value obtained by determining a difference of the temporal variations of the light amounts of delayed fluorescence within a predetermined range between one characteristic point and a measurement starting point or another characteristic point is used as the comparison value to assay the toxic substance.

4. The toxic substance assay method according to Claim 2 ~~or 3~~, wherein, in the third step, a value, determined as a ratio of a value determined as a difference of the temporal variations of the light amounts of delayed fluorescence acquired in the first step and the second step, with respect to the temporal variation of the light amount of delayed fluorescence acquired in the first step or the second step, is used as the comparison value to assay the toxic substance.

5. The toxic substance assay method according to Claim 1 ~~any of Claims 1 to 4~~, wherein in the second step, a standard sample to be compared with is used as the comparison sample, the photosynthetic sample is mixed with the standard sample to prepare a standard measurement solution that is the comparison measurement solution, the standard measurement solution is left to stand for the predetermined standing time, and then after illuminating light onto the standard measurement solution for the predetermined illumination time, the light amount of the delayed fluorescence that is emitted is measured to acquire the comparison measurement result.

6. The toxic substance assay method according to Claim 1 ~~any of Claims 1 to 4~~, wherein in the second step, another aqueous solution

sample is used as the comparison sample and a measurement result, acquired on another test measurement solution that is the comparison measurement solution prepared by mixing the other aqueous solution sample with the photosynthetic sample, is prepared as the comparison measurement result.

7. The toxic substance assay method according to Claim 1~~any of Claims 1 to 6~~, wherein, in the second step, a measurement result, acquired in advance for the comparison measurement solution, is prepared as the comparison measurement result.

8. The toxic substance assay method according to Claim 1~~any of Claims 1 to 7~~, wherein in the first step and the second step, the test measurement solution and the comparison measurement solution are left to stand for a predetermined standing time with light conditions being varied in each measurement, and

in the third step, a variation of the comparison values according to the light conditions is evaluated.

9. The toxic substance assay method according to Claim 1~~any of Claims 1 to 8~~, wherein the densities of the photosynthetic sample in the test measurement solution and in the comparison measurement solution are within a range of densities that are in a proportional relationship with the light amount of delayed fluorescence.

10. The toxic substance assay method according to Claim 1~~any of Claims 1 to 9~~, wherein in the first step and the second step, the test measurement solution and the comparison measurement solution are homogenized before measuring the light amount of delayed fluorescence.

11. The toxic substance assay method according to Claim 1~~any of Claims 1 to 10~~, wherein the photosynthetic sample includes at least one type of photosynthetic sample, selected from the group consisting of halotolerant algae, alkali-tolerant algae, and acid-tolerant algae.

5 12. The toxic substance assay method according to Claim 11, wherein the photosynthetic sample is Spirulina.

13. A toxic substance assay method for assaying a toxic substance present in an aqueous solution sample to be tested, the toxic substance assay method comprising:

10 a preparing step of mixing the aqueous solution sample with a photosynthetic sample, having a photosynthetic function, to prepare a test measurement solution;

 a standing step of letting the test measurement solution stand for a predetermined standing time;

15 a measuring step of illuminating light onto the test measurement solution for a predetermined illumination time and thereafter measuring the light amount of delayed fluorescence that is emitted;

 an assaying step of assaying the toxic substance present in the aqueous solution sample based on the light amount of delayed
20 fluorescence acquired in the measuring step; and

 an acclimating step, preceding the measuring step and including one of either a dark standby step of subjecting the test measurement solution to a dark standby for a predetermined standby time or a preliminary illuminating step of subjecting the test measurement
25 solution to a preliminary light illumination and to a dark standby for a predetermined standby time.

14. The toxic substance assay method according to Claim 13, wherein in the dark standby step, the predetermined standby time is no less than 30 seconds and no more than 1 hour.

15. The toxic substance assay method according to Claim 13 ~~or 14~~, wherein the ratio of the preliminary light illumination time to the dark standby time in the preliminary illuminating step is equal to the ratio of the light illumination time to the dark standby time in the measuring step.

16. A toxic substance assay kit for assaying a toxic substance present in an aqueous solution sample to be tested, the toxic substance assay kit comprising:

a photosynthetic sample to be mixed with the aqueous solution sample;

a salt mixture for adjusting the salt concentration and pH of the aqueous solution sample; and

a mixing means that mixes the aqueous solution sample with the photosynthetic sample and with the salt mixture in a separated manner.

17. The toxic substance assay kit according to Claim 16, further comprising a stabilizer for homogenizing the distribution density of the photosynthetic sample.

18. The toxic substance assay method according to Claim 2, wherein in the second step, a standard sample to be compared with is used as the comparison sample, the photosynthetic sample is mixed with the standard sample to prepare a standard measurement solution that is the comparison measurement solution, the standard measurement solution is left to stand for the predetermined standing time, and then

after illuminating light onto the standard measurement solution for the predetermined illumination time, the light amount of the delayed fluorescence that is emitted is measured to acquire the comparison measurement result.

5 19. The toxic substance assay method according to Claim 2,
wherein in the second step, another aqueous solution sample is used as
the comparison sample and a measurement result, acquired on another
test measurement solution that is the comparison measurement solution
prepared by mixing the other aqueous solution sample with the
10 photosynthetic sample, is prepared as the comparison measurement
result.

20. The toxic substance assay method according to Claim 2,
wherein, in the second step, a measurement result, acquired in advance
for the comparison measurement solution, is prepared as the comparison
15 measurement result.

21. The toxic substance assay method according to Claim 2,
wherein in the first step and the second step, the test measurement
solution and the comparison measurement solution are left to stand for a
predetermined standing time with light conditions being varied in each
20 measurement, and

in the third step, a variation of the comparison values according
to the light conditions is evaluated.

22. The toxic substance assay method according to Claim 2,
wherein the densities of the photosynthetic sample in the test
25 measurement solution and in the comparison measurement solution are
within a range of densities that are in a proportional relationship with

the light amount of delayed fluorescence.

5 23. The toxic substance assay method according to Claim 2,
wherein in the first step and the second step, the test measurement
solution and the comparison measurement solution are homogenized
before measuring the light amount of delayed fluorescence.

24. The toxic substance assay method according to Claim 2,
wherein the photosynthetic sample includes at least one type of
photosynthetic sample, selected from the group consisting of
halotolerant algae, alkali-tolerant algae, and acid-tolerant algae.

10 25. The toxic substance assay method according to Claim 24,
wherein the photosynthetic sample is Spirulina.